

PRINT CONTROL APPARATUS, PRINT CONTROL
METHOD, PROGRAM PRODUCT, AND PRINT SYSTEM

BACKGROUND OF THE INVENTION

5 Field of the Invention

The invention relates to a print system which has a plurality of queues for managing a plurality of jobs and can perform proxy printing from one queue to another queue.

10 Related Background Art

Hitherto, a print system which detects an error of a printing apparatus or discriminates a size of job inputted to a queue and can perform proxy printing to another print queue or the printing
15 apparatus has existed.

In the conventional print system, however, there is a problem such that the job is added to the end of the queue of a proxy destination at the time of the proxy printing and, if the proxy printing is
20 executed, it takes a longer time to complete the printing than in the case where the proxy printing is not performed. In a system which discriminates the execution of the proxy printing upon job transmission, there is a problem such that the job is
25 unconditionally transmitted to a device which can print, so that the job which was proxy-printed later is printed first.

SUMMARY OF THE INVENTION

The invention is made to solve the above problems and it is an object of the invention to execute smooth scheduling also upon proxy printing
5 and optimize job scheduling in view of the whole system.

To accomplish the above object, according to the invention, there is provided a print control apparatus comprising:

10 a changing unit for changing a priority of a job upon proxy printing; and

an executing unit for executing a printing process on the basis of the priority changed by the changing unit.

15 According to the invention, there is provided a print system comprising:

a plurality of print queues for managing a plurality of jobs;

scheduling means for processing a print job
20 inputted to each of the queues on the basis of priorities allocated to the jobs;

proxy printing means for making proxy of the job from the original queue to another queue; and

automatic priority changing means for
25 automatically raising the priority of the job by one point when the proxy printing is executed.

According to the invention, there is also

provided a print system comprising:

a plurality of print queues for managing a plurality of jobs;

scheduling means for processing a print job
5 inputted to each of the queues on the basis of priorities allocated to the jobs;

proxy printing means for making proxy of the job from the original queue to another queue; and

priority automatic setting means for
10 automatically setting the priority of the job on the basis of reception time of the jobs when the proxy printing is executed.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is a functional block diagram of a print system to which the invention is applied;

Fig. 2 is a flowchart showing an outline of the print system to which the invention is applied;

Fig. 3 is an example of a job information
20 management table in the print system of the invention;

Fig. 4 is a flowchart showing an example of a job receiving process;

Fig. 5 is a flowchart showing an outline of a
25 proxy printing process in the print system of the invention;

Fig. 6 is a flowchart showing an example of a

job transmitting process;

Fig. 7 is a flowchart showing an outline of a proxy printing process in a print system according to another embodiment of the invention;

5 Fig. 8 is a diagram showing a relation between a print system 660 provided by Windows (registered trademark) and print jobs in a print job control system;

Fig. 9 is a diagram showing a user interface
10 display screen for setting a print property of logical printer management 705; and

Fig. 10 is a diagram showing an outline of a network construction using the print system of the invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the invention will be described hereinbelow with reference to the drawings.
<Example of construction of a print processing
20 system>

Fig. 10 is a diagram showing a construction of a print processing system according to an embodiment.

In the diagram, reference numerals 101, 102, 103, and 104 denote network computers which are
25 connected to a network 106 and can communicate with each other. Typically, they are personal computers (PCs).

Among them, reference numerals 102, 103, and 104 denote the client computers (hereinafter, referred to as clients) which are connected to the network 106 by a network cable such as Ethernet (registered trademark) or the like. The clients 102 to 104 can execute various programs such as an application program and the like. A printer driver having a function for converting print data into a printer language corresponding to a printer has been installed in each client. It is now assumed that each client supports a plurality of printer drivers.

On the other hand, reference numeral 101 denotes the server computer (hereinafter, referred to as a server) which is connected to the network 106 by the network cable. The server 101 accumulates files which are used on the network and monitors a using state of the network 106. The server also functions as a print server for managing printers connected to the network 106. Specifically speaking, the print server 101 has: a function for storing print jobs to which print requests have been made by the client computers 102, 103, and 104 and include print data and printing them; a function for receiving job information including no print data from the client computers 102 to 104, managing print order, and notifying transmission permission of the print job including the print data to the client whose print

order has come; a function for obtaining various information such as status and print job of a printer device (print device) 105, which will be explained hereinlater and notifying the client computers 102 to 104 of them; and the like. The server computer 101 is logical existence in which the functions of the server operate in the print system of the invention. As shown in Fig. 1, the dedicated server computer can be also provided. It is also possible to substitute the functions of the server computer for the functions of the client computers 102 to 104 or the printer device 105.

Reference numeral 105 denotes the printer device as a print control unit. The printer device 105 is connected to the network 106 via a network interface (not shown), analyzes the print jobs including the print data which are transmitted from the client computers, converts them into dot images one page by one, and prints them. Although only one printer device 105 is shown in the diagram, a plurality of other printer devices can be also connected. Functions of the printer devices can be also different.

Reference numeral 106 denotes the network which connects the client computers 102 to 104, the print server 101, the printer device 105, and the like.

Fig. 1 is a logical block diagram showing

functions of a print system according to the invention. The print system is constructed by: a job forming unit 11 for converting data; a job management unit 12 for monitoring a process of a job regarding a printing process; a print queue 13; a GUI processing unit 18 constructing a user interface portion; and a print processing unit 14 for actually executing the printing process.

The job forming unit 11 has a function for converting job data received from an outside into a format which can be understood by a subsequent subsystem and transferring the converted data to the job management unit 12. If the job forming unit 11 is constructed on a user PC, the job forming unit 11 has a function for converting a document formed by a word processor, a spreadsheet, or the like into job data in a format according to an external specification of the printing apparatus. Further, if the job forming unit 11 is constructed on the printing apparatus, the job forming unit 11 has a function for converting the job data in an external format received from a host computer into a data format which is managed in the apparatus.

The job management unit 12 has a function generally called a spooler. The job management unit 12 has functions for storing jobs received from the job forming unit 11 into the print queue 13 (spooling

process) and sequentially reading out the jobs from the print queue 13 by a FIFO method (de-spooling process) and transferring the jobs to the print processing unit 14. The job management unit 12 has
5 functions such as stop, restart, and deletion of the job, change in priority, and the like which have been defined by ISO10175 and has a role of receiving commands from an external system and executing those functions. The job management unit 12 can be
10 arranged to one or both of the printing apparatus and the host computer.

The jobs in the print queue 13 are identified by unique IDs. The job management unit 12 has a function for managing a correspondence between the
15 IDs and the job data. All subsystems which use the job management unit 12 can control the jobs by designating the IDs. The print queue 13 can be arranged on an arbitrary non-volatile memory medium such as hard disk, NVRAM, DVD-RAM, or the like or a
20 volatile memory such as a RAM or the like and it is not always necessary that the print queue 13 exists on the same apparatus as that of the job management unit 12.

Reference numeral 14 denotes the print
25 processing unit having roles of developing the job data sent from the job management unit 12 into a format according to a printer engine and transferring

it onto recording paper by using ink, toner, or the like.

Reference numeral 18 denotes the GUI processing unit having an event handling unit 15, a program control unit 16, and a job display unit 17. The GUI processing unit 18 has a role of a window to provide a display of a list of the jobs managed by the job management unit 12 to the user and supply an input from the user to the print system. The GUI processing unit 18 is generally arranged on the printing apparatus or the PC of the user or the operator.

The event handling unit 15 has roles in handling hardware interruption from an input apparatus such as keyboard, mouse, touch panel, or the like, forming logical events such as mouse movement event, mouse click event, keyboard depression event, and the like, and calling back a processing program defined by the program control unit 16.

The program control unit 16 has functions for analyzing, in detail, the event supplied from the event handling unit 15, detecting the instructed job from the information of the jobs displayed on the job display unit 17, and transferring a request to the job management unit 12 in order to execute a command process in response to the detected job. The program

control unit 16 further has a function for obtaining
a list of the jobs from the job management unit 12 or
instructing the job display unit 17 to update the
display in accordance with a job change event
5 notification from the job management unit 12 as
necessary.

The job display unit 17 has a graphical user
interface.

Block shown in Fig. 1 can be arranged on one
10 printing apparatus or different printing apparatuses
or the host computers every block, respectively.
Further, the number of blocks is not limited to one
in one print system. In the system of the invention,
a plurality of print processing units are provided
15 and the print queues are also provided for the print
processing units in a one-to-one correspondence
relational manner. The present print system is
constructed in a manner such that if a fault occurs
in the print processing unit, the job which is in a
20 "printing" status or a "print waiting" status can be
moved (proxy printing) from the print queue to
another print queue.

A layout of the blocks in the system is
provided for the system by an initialization file, a
25 directory, or hardware coding to a program code. If
two blocks exist in the same process, a procedure
call (function call) or message communication is used

as inter-block communicating means. If the blocks exist in different processes or PCs, a socket of TCP/IP, an RPC, or the like is used as inter-block communicating means. In any of the above cases,
5 communication can be made between the blocks irrespective of the layout of the blocks.

Although the blocks can be arranged in arbitrary apparatuses, they are fixed in principle when the print system to which the invention is
10 applied is made operative. For example, the job display unit does not dynamically move to the printing apparatus from the host computer which is operated by the user. As an exception, the blocks such as job management unit, print processing unit,
15 and the like which can move logically among a plurality of apparatuses in accordance with an error or a processing situation can exist.

<Relation between the Windows (registered trademark) print system and the print jobs>

20 Subsequently, an example of performing the proxy printing by using a plurality of queues will be described with reference to Fig. 8. The print queue 13 in Fig. 1 mentioned above corresponds to printer queues 722A and 722B in Fig. 8. The job forming unit
25 11 in Fig. 1 corresponds to a group printer driver 603 and PDL drivers 602A and 602B in Fig. 8. The job management unit 12 in Fig. 1 corresponds to a job

control print service in Fig. 8. The print
processing unit 14 in Fig. 1 corresponds to printer
controllers in printer devices 650A and 650B. A
relation between the print system which is provided
5 by Windows (registered trademark) and the print jobs
in a print job control system and an outline of
processes will be described further in detail. A
processing system of Fig. 8 relates to the printing
process which is executed via the group printer
10 driver 603.

A print job control system 700 in Fig. 8 shows
a range of the print job control system which
stretches over physical machines in which control
programs of a server 101 and a client, 102, 103, or
15 104 operate. An output port 711 which is managed by
the server 101 is concerned with a proxy output port
712 of a job control print service 622 of the client.
All proxy output ports on each client concerned with
one port are unitarily managed.

20 In the embodiment, actual print job data is
held in the proxy output port 712 of each client. A
job control server 630 does not executes a
transmitting process of print job data itself but
executes only a transmitting instruction of the print
25 job to the job control print service 622. In
response to the instruction, the job control print
service 622 of the client transmits the print job

data to a printer device 650.

Subsequently, processes in the case where the print job control system 700 executes printing with an added value such as proxy printing, distribution printing, multi-address printing, or the like will be described.

When the print job control system 700 executes the printing with an added value such as proxy printing, distribution printing, multi-address printing, or the like, as one method, it is necessary that the user or an application 601 issues the print job to the printer to which the group printer driver 603 has been allocated as mentioned above. As will be explained hereinlater, as another method, if the port of the output destination of a PDL driver 602 has been allocated to a job control port monitor 621, the print job can be issued to the PDL driver 602.

When the application 601 starts the printing process, the group printer driver 603 obtains logical queue information (which will be explained hereinlater) of the job control print service 622 and sets information which can be referred to by a print property into a general print file. Fig. 9 shows an example of a user interface display screen for setting the print property of logical printer management 705. As shown in the diagram, "auto proxy" can be selected as an outputting method here

and, further, an output destination printer (member printer driver) can be registered in a state where a priority is added thereto.

5 The job control print service 622 receives the
job data, as a general print file, processed by the
group printer driver 603 via the job control port
monitor 621. The job control print service 622
receives the print job and issues a job (member job)
to another printer to which a PDL driver has been
10 allocated via a de-spooler 701, thereby allowing the
printer to print. In a manner similar to that of an
ordinary application, the de-spooler 701 forms a draw
command (GDI function) via drawing means of an OS and
outputs it on the basis of document data of the
15 general print file as a print job, and the PDL driver
602A receives a draw command (DDI function).

 At this time, the de-spooler 701 interprets a
print instructing unit (job ticket unit) of general
print file, modifies document data of a document data
20 unit, converts it into a GDI of Windows (registered
trademark), instructs each printer driver to print,
and issues the print job. For example, if an
instruction "2-UP" has been recorded in a print style
designating unit, the document data of two pages is
25 reduced and arranged onto one sheet. In the case of
the distribution printing or the multi-address
printing, jobs are issued to a plurality of member

printers described in the print instructing unit in accordance with the setting. In the case of the proxy printing, when conditions for performing the proxy printing are satisfied, the member job is
5 issued in accordance with the previous setting in the automatic proxy or in accordance with the operation of the user in the manual proxy.

There is also presumed a form such that the instruction information corresponding to each member
10 printer driver is extracted from the print instructing unit to a module different from the foregoing de-spooler 701 and the de-spooler 701 interprets the extracted print instruction to each of the extracted member printer drivers.

15 Further, when the job is issued to each member printer, as a print instruction corresponding to each member printer driver, the de-spooler 701 needs to form DEVMODE (print set information) of each member printer. DEVMODE is formed by properly reflecting
20 contents disclosed in the print instructing unit to DEVMODE of each member printer. In the embodiment, since the explanation is made with respect to the print system using Windows (registered trademark) 2000 or Windows (registered trademark) XP as an OS of
25 Microsoft Corporation in U.S.A., DEVMODE as a structure which can be controlled by the printer driver is used as print set information. However, it

is unnecessary that the print set information is limited to DEVMODE but a file in an XML format in which the print set information has been described can be used. That is, a method of transferring the
5 print set information to the printer driver differs depending on the OS and the invention is not limited to one of them.

The job control print service 622 on the client side receives PDL data of each member job formed by
10 the PDL driver 602 via the job control port monitor 621 and notifies the server 101 side of the information regarding the received print job in the PDL format. The job data is temporarily held in its own proxy output port 712A or 712B. After that, when
15 a transmitting instruction from the job control server 630 is received, the print job control system 700 transmits the print data in the PDL format to the printer device 650 via the proxy output port 712.

With the construction of Fig. 8, for example,
20 in the case of (automatically or manually) performing the proxy of the job stored in the printer queue 722A, the job control print service moves the job to the printer queue 722B in response to an instruction of the (automatic or manual) proxy and outputs the job
25 to the printer device 650B, so that the proxy printing from the printer device 650A to the printer device 650B can be executed.

Fig. 2 is a flowchart for explaining an outline of a program of processes in the program control unit. First, in step S200, the program control unit 16 itself and the subsystem are initialized. In next
5 step S201, the processing routine enters an infinite loop for waiting for an event. Step S201 is finished when an event such as mouse, keyboard, job reception, or the like is generated and the processing routine advances to the following event process.

10 In step S202, whether the generated event is an update event of the job list or not is discriminated. If YES, in step S203, the program control unit 16 obtains a list of new job information from the job management unit 12 and instructs the job display unit
15 17 to update and display the list of the job information. After completion of step S203, the processing routine advances to the process for waiting for the event in step S201.

If NO in step S202, whether the generated event
20 is a job reception event or not is discriminated in subsequent step S204. If YES, the processing routine advances to a job receiving process in step S205. Details of this process will be explained hereinlater with reference to Fig. 4. After completion of step
25 S205, the processing routine advances to the process for waiting for the event in step S201.

If NO in step S204, whether the generated event

is a print error event or not is discriminated in subsequent step S206. If YES, a proxy printing process is executed in step S207. Details of this process will be explained hereinlater with reference
5 to Fig. 5. After completion of step S207, the processing routine advances to the process for waiting for the event in step S201.

If NO in step S206, whether the generated event is a job transmission event or not is discriminated
10 in subsequent step S208. If YES, a job transmitting process is executed in step S209. Details of this process will be explained hereinlater with reference to Fig. 6. After completion of step S209, the processing routine advances to the process for
15 waiting for the event in step S201.

If NO in step S208, whether the generated event is another event or not is discriminated in subsequent step S210. If YES, another event process is executed in next step S211. Since this process is
20 not directly concerned with the present invention, its detailed explanation is omitted here. After completion of step S211, the processing routine advances to the process for waiting for the event in step S201.

25 If NO in step S210, whether an end event has been generated or not is discriminated in step S212. If NO, it is regarded that an invalid event has been

generated and the processing routine is returned to the process for waiting for the event in step S201. If YES, a finishing process in step S213 is executed and the present processing routine is stopped.

5 Fig. 3 shows a part of a job information management table held on a memory in the job management unit 12. All jobs have unique identifiers (JobID) in the print system and are managed so as to be distinguished from other jobs. Besides the
10 identifier, each job has information such as processing status, priority, reception time, user name, document name, printing apparatus selected first by the user, and the like. It will be understood from Fig. 3 that there are four jobs in
15 total and a document .doc of a JobID 200 is in a status "printing", the job of JobID 201 is in a status "transmitting", and the other two jobs are in a status "transmission waiting". One job information in the job information management table is generally
20 formed at a point of time when the print system receives the job and this job information is extinguished at a point of time when the paper delivery is completed by the printing apparatus or a cancelling process is executed by a reasons of the
25 user or the device. If the target printing apparatus does not support a paper delivery completion confirming function, the job information is

extinguished after completion of the transmission of the job.

Fig. 4 is a flowchart showing an outline of a program of a job receiving process of the print system according to the invention. In the job receiving process, upon reception, first, an identifier (JobID) to uniquely identify this job in the system is allocated in step S400. As a JobID, a unique ID such as UUID (Universally Unique Identifier) or the like can be used. A sequential number issued on the server is used in the system in the embodiment. Subsequently, in step S401, fundamental job attributes, such as the job or queue name, user name, document name, priority, and the like which are used during job script or in printing by an option or the like of the received command, are designated and the job information is formed. If there are attributes which are not designated, values of default prepared in the system are used as attributes. Subsequently, in step S402, the job information formed in step S401 is registered and the job information management table is updated. When the list is updated, a job list update event is set in an interlocking relational manner. When the job list update event is set, the foregoing job list updating process is activated by the system. In next step S403, a job transmission event is set into the

print queue designated in step S401. When the job transmission event is set, a job transmitting process is activated. The above processes will be explained in detail with reference to Fig. 6.

5 Fig. 5 is a flowchart showing an example of a program of a proxy printing process which is executed in the print system according to the invention.

 The proxy printing process is automatically executed when an error of the device is generated in the print system of the invention or is executed at
10 arbitrary timing by an instruction of the user (or a command from an external system which monitors the print system).

 When the proxy printing process is activated, a
15 proxy destination is selected in a proxy destination selecting process in step S500. As a selecting method of the proxy destination, there are a method of previously registering a substitute queue corresponding to the queue, a method of instructing
20 it as an attribute of the job upon printing, a method whereby candidates are displayed to the operator and he selects a proper one, and the like. Since such a selecting method is not directly concerned with the invention, it is not described in detail here.

25 Whether a proxy destination has been found or not is discriminated in next step S501. If the proxy destination is not found, the proxy process is

finished.

If it is determined in step S501 that the proxy destination exists (YES), the job information of the job to be subjected to the proxy is restored in step
5 S502. This information is used later when the proxy of the job is performed. In next step S503, the original job is cancelled. The print system of the invention can have not only a function such that when a job cancelling process is executed, the job
10 information is deleted but also a function such that while the printing process is executed in the print processing unit, the printing process is interrupted. Further, in step S504, the print queue information of the job information held in step S502 is changed to
15 the print queue selected in step S500. In step S505, the priority of the job is raised by one point. In step S506, new job information is registered into the job information management table. The job processing status in the job information is initialized to
20 "transmission waiting" upon registration. The job list update event is set. In subsequent step S507, the job transmission event is set into the newly selected print queue and the proxy process is finished.

25 Fig. 6 is a flowchart showing an embodiment of a program of a job transmitting process in the print system of the invention. In the print system of the

invention, the job transmitting processes are activated in parallel every print queue. In the job transmitting process, in step S600, one job of the highest priority among the untransmitted jobs (the
5 jobs in each of which the status is a status before "transmitting") is selected. If it is determined in step S601 that the job is not selected, this means that the untransmitted job does not exist in the print queue which is at present being processed. The
10 job transmitting process is finished.

If the job is selected in step S601, the status of the job is updated to "transmitting" and the job list update event is set in step S602. In next step S603, the job data is read and the job is transferred
15 to the print processing unit. As a transferring method of the job, although there are many methods such as LPR, FTP, IPP, and the like, since they are not directly concerned with the invention, its explanation is omitted here. Since processes which
20 are executed when the job transmission fails are also not directly concerned with the invention, their explanation is omitted here. After completion of the job transmission, the status of the job is set to "transmitted" and the job list update event is set in
25 step S604. The job transmitting process is finished.

As described above, in the print system according to the embodiment of the invention, at the

time of the proxy printing, by automatically raising the priority of the job by one point, the smooth scheduling is executed and the scheduling in the whole system can be optimized. Therefore, the
5 problem such that the job is added to the last of the queue of the proxy destination at the time of the proxy printing and it takes a surplus longer output time or the problem such that the job unconditionally outruns another job can be avoided.

10 (Other embodiments)

Although the embodiment has been described above with respect to an example in which the smooth scheduling is executed by automatically raising the priority of the job by one point upon proxy printing,
15 subsequently, explanation will be made with respect to another embodiment in which the smooth scheduling is executed by automatically setting the priority of the job in accordance with the reception time of the job upon proxy printing.

20 Since the print system, the processes in the program control unit, the job receiving process, the job transmitting process, and the like are similar to those in the foregoing embodiment, their explanation is omitted here.

25 Fig. 7 is a flowchart showing an embodiment of the proxy printing processes which are executed in the print system according to another embodiment of

the invention.

The proxy printing process is automatically executed when an error of the device is generated in the print system of the invention, or it is executed
5 at arbitrary timing by an instruction of the user (or a command from an external system which monitors the print system).

When the proxy printing process is activated, a proxy destination is selected in the proxy
10 destination selecting process in step S500. As a selecting method of the proxy destination, there are a method of previously registering a substitute queue corresponding to the queue, a method of instructing it as an attribute of the job upon printing, a method
15 whereby candidates are displayed to the operator and he selects a proper one, and the like. Since such a selecting method is not directly concerned with the invention, it is not described in detail here.

In subsequent step S501, whether the proxy
20 destination has been found or not is discriminated. If the proxy destination is not found, the proxy process is finished.

If it is determined in step S501 that the proxy destination exists (YES), the job information of the
25 job to be subjected to the proxy is restored in step S502. This information is used later when the proxy of the job is performed. In next step S503, the

original job is cancelled. The print system of the invention can have not only a function such that when the job cancelling process is executed, the job information is deleted but also a function such that
5 while the printing process is executed in the print processing unit, the printing process is interrupted. Further, in step S504, the print queue information of the job information held in step S502 is changed to the print queue selected in step S500. In step S705,
10 new job information is registered into the job information management table. The job processing status in the job information is initialized to "transmission waiting" upon registration. In step S706, the priorities of the jobs in the proxy
15 destination queue are reset in accordance with the reception time of the job.

For example, in Fig. 3, if the proxy destination of a job shown by JobID 203 is changed from the Printer A to the Printer B, since the
20 reception time of JobID 203 is 10:21:33, this job is preferentially executed rather than the job of JobID 202 whose reception time is 10:23:35. Therefore, the priority of JobID 203 is set to 2. If the proxy of the job received at 10:22:00 between JobID 202 and
25 JobID 203 is performed, the priority of this job is set to 2 and that of JobID 203 is set to 3. After the priorities of the jobs were reset, the job

transmission event is set into the proxy destination queue and the proxy process is finished.

As described above, in the print system according to the embodiment of the invention, the smooth scheduling is executed by automatically
5 setting the priority of the job in accordance with the reception time of the job upon proxy printing and the scheduling in the whole system can be optimized. Therefore, the problem such that the job is added to
10 the last of the queue of the proxy destination at the time of the proxy printing and it takes a surplus longer output time or the problem such that the job unconditionally outruns another job can be avoided.

Naturally, the objects of the invention are
15 also accomplished by a method whereby a memory medium in which program codes of software to realize the functions (the processes in the program control unit, the job receiving process, the proxy printing process, the job transmitting process, etc.) of the
20 embodiments mentioned above have been recorded is supplied to a system or an apparatus and a computer (or a CPU or an MPU) of the system or the apparatus reads out and executes the program codes stored in the memory medium.

25 In this case, the program codes themselves read out from the memory medium realize the functions of the embodiments mentioned above and the memory medium

in which the program codes have been stored
constructs the invention.

As a memory medium for supplying the program
codes, for example, a floppy disk, a hard disk, an
5 optical disk, a magnetooptic disk, a CD-ROM, a CD-R,
a magnetic tape, a non-volatile memory card, a ROM,
or the like can be used.

Naturally, the invention incorporates not only
a case where a computer executes the read-out program
10 codes, so that the functions of the embodiments
mentioned above are realized but also a case where an
OS (Operating System) or the like which is operating
on the computer executes a part or all of actual
processes on the basis of instructions of the program
15 codes and the functions of the embodiments mentioned
above are realized by those processes.

Further, naturally, the invention also
incorporates a case where the program codes read out
from the memory medium are written into a memory
20 provided for a function expanding board inserted into
a computer or a function expanding unit connected to
a computer and, thereafter, a CPU or the like
provided for the function expanding board or the
function expanding unit executes a part or all of
25 actual processes on the basis of instructions of the
program codes and the functions of the embodiments
mentioned above are realized by those processes.